UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/893,477	06/29/2001	Keiji Minetani	010781	5295

23850 7590 08/21/2003

ARMSTRONG,WESTERMAN & HATTORI, LLP
1725 K STREET, NW
SUITE 1000
WASHINGTON, DC 20006

EXAMINER
LEWIS, MONICA

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 08/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/893,477	MINETANI, KEIJI
	Examiner	Art Unit
	Monica Lewis	2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. This office action is in response to the amendment filed May 29, 2003.

Response to Arguments

2. Applicant's arguments with respect to claims 1-11 have been considered but are moot in view of the new ground(s) of rejection.

Claim Objections

3. Claim 7 is objected to because of the following informalities: a) there is already a buffer layer formed in claim 1. It does not appear that there should be two buffer layers. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 6-8 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Ando et al. (U.S. Patent No. 5,373,168).

In regards to claim 1, Ando et al. ("Ando") discloses the following:

a.) a substrate (1) formed of a first compound semiconductor (For Example: See Figure 3a);

b) a buffer layer (2) formed on the substrate (For Example: See Figure 3a);

c) a graded channel layer (23a-23d) formed on the buffer layer, said graded channel layer composed of a second compound semiconductor layer doped with an impurity of which one constituent element of said second compound semiconductor layer has a peak of a distribution in the inside of said graded channel layer in a thickness direction, thereby an energy band gap of the graded channel layer is made narrower in the inside than at both ends in the thickness direction (For Example: See Figures 3a-3c);

d) a barrier layer (14) formed on the graded channel layer (For Example: See Figure 3a);

e) a source electrode (6)and a drain electrode (8) formed both sides of the gate electrode (7) to flow a current into the graded channel layer (For Example: See Figure 3a); and

f) a gate electrode formed on the barrier layer to come into Schottky-contact with the barrier layer (For Example: See Figure 3a).

In regards to claim 6, Ando discloses the following:

a) contact layers are formed between the source electrode and the barrier layer and between the drain electrode and the barrier layer respectively (For Example: See Figure 3a).

In regards to claim 7, Ando discloses the following:

a) a buffer layer is formed between the substrate and the graded channel layer (For Example: See Figure 3a).

In regards to claim 8, Ando discloses the following:

a) the first compound semiconductor constituting the substrate is GaAs, and the second compound semiconductor layer constituting the graded channel layer is InGaAs, and the one constituent element contained in the second compound semiconductor layer is indium (For Example: See Figure 3a).

In regards to claim 11, Ando discloses the following:

a) second compound semiconductor layer is consisted of a ternary or quaternary of group III-V semiconductor including at least one of gallium and indium as group III element and including at least one arsenic, phosphorus, and antimony as group V element (For Example: See Figure 3a).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 2-5 are rejected under 35 U.S.C. 103(a) as obvious over Ando (U.S. Patent No. 5,373,168).

In regards to claim 2, Ando fails to disclose the following:

a) the second compound semiconductor layer is composed of a material that one constituent element is added in the first compound semiconductor and the one constituent element has a function which makes the energy band gap of the second compound semiconductor layer narrower than that of the first compound semiconductor.

Although, Ando does not specifically disclose the limitations listed above. It would have been obvious that the second compound layer would have the characteristics stated above because both layers are made of $In_yGa_{1-y}As$.

In regards to claim 3, Ando fails to disclose the following:

a) a peak of the one constituent element in the graded channel layer is positioned at a center of a layer thickness of the graded channel layer, or positioned at a position that is deviated from the center.

Although, Ando does not specifically disclose the limitations listed above. It would have been obvious that the graded channel layer would have the characteristics stated above because both layers are made of $In_yGa_{1-y}As$.

In regards to claim 4, Ando fails to disclose the following:

a) a peak of carrier density in the graded channel layer is positioned at a center of a layer thickness of the graded channel layer, or deviates from the center.

Although, Ando does not specifically disclose the limitations listed above. It would have been obvious that the graded channel layer would have the characteristics stated above because both layers are made of $In_yGa_{1-y}As$.

In regards to claim 5, Ando fails to disclose the following:

a) a peak of carrier density in the graded channel layer sifts to the substrate side from a center of a layer thickness of the graded channel layer.

Although, Ando does not specifically disclose the limitations listed above. It would have been obvious that the graded channel layer would have the characteristics stated above because both layers are made of $In_yGa_{1-y}As$.

8. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as obvious over Ando (U.S. Patent No. 5,373,168) in view of Kuroda et al. (U.S. Patent No. 5,837,565).

In regards to claim 9, Ando discloses the following:

a) first compound semiconductor constituting the substrate is GaAs (For Example: See Figure 1).

In regards to claim 9, Ando fails to disclose the following:

a) second compound semiconductor layer constituting the graded channel layer is GaAsSb or InGaSb, and the one constituent element contained in the second compound semiconductor layer is indium or antimony.

However, Kuroda et al. ("Kuroda") discloses a semiconductor device which has a layer composed of GaAsSb (For Example: See Column 4 Lines 66-67 and Column 5 Lines 1-5). It would have been obvious to one having ordinary skill in the art at the time the invention was

made to modify the semiconductor device of Ando to include a layer composed of GaAsSb as disclosed in Kuroda to aid in increasing the speed of the device.

Additionally, since Ando and Kuroda are both from the same field of endeavor, the purpose disclosed by Kuroda would have been recognized in the pertinent art of Ando.

In regards to claim 10, Ando fails to disclose the following:

a) the first compound semiconductor constituting the substrate is InP, and the second compound semiconductor layer constituting the graded channel layer is InAsP or GaAsSb or InPSb, and one constituent element contained in the second compound semiconductor layer is indium or antimony.

However, Kuroda discloses a semiconductor device which has a layer composed of GaAsSb (For Example: See Column 1 Lines 15-67 and Column 2 Lines 1-39, Column 4 Lines 66-67 and Column 5 Lines 1-5). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Ando to include a layer composed of GaAsSb as disclosed in Kuroda to aid in increasing the speed of the device.

Additionally, since Ando and Kuroda are both from the same field of endeavor, the purpose disclosed by Kuroda would have been recognized in the pertinent art of Ando.

Conclusion

9. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: a) Chang (U.S. Patent No. 5,652,440) discloses a high electron transistor.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Michael Trinh
Primary Examiner
Act SPE

ML

August 11, 2003